shadow $\frac{1}{2}$ s later

$s = 16t^2$

variables: x, s

rates: $\frac{dx}{dt}$ = find

$\frac{ds}{dt} = 32t = 16$

$\frac{50}{30+x} = \frac{50-s}{x}$

$50x = (30+x)(50-s)$

$50x = 1500 + 50x - 30s - xs$

$30s + xs = 1500$

$30\frac{ds}{dt} + x\frac{ds}{dt} + s\frac{dx}{dt} = 0$

$30 \cdot 16 + 345 \cdot 16 + 4\frac{dx}{dt} = 0$

$\frac{dx}{dt} = \frac{-30 \cdot 16 - 345 \cdot 16}{4}$

$\frac{dx}{dt} = -1500 \frac{ft}{sec}$

$s = 16\left(\frac{1}{2}\right)^2 = 4$

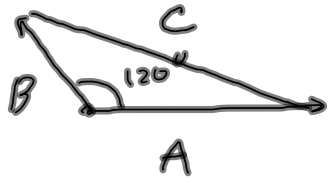
$30 \cdot 4 + x \cdot 4 = 1500$

$x = \frac{1500 - 120}{4}$

$x = 345$

Nov 1-7:55 AM

35.



law of cosines:

$A^2 + B^2 - 2AB\cos\theta = C^2$

$A^2 + B^2 - 2AB\left(-\frac{1}{2}\right) = C^2$

$A^2 + B^2 + AB = C^2$

A: 14 knot = $\frac{dA}{dt}$

B: 21 knot = $\frac{dB}{dt}$

$DA = 5 = A$

$DB = 3 = B$

find $\frac{dc}{dt}$

Nov 1-8:07 AM

47. $y = uv$

$$\frac{dy}{dt} = u\frac{dv}{dt} + v\frac{du}{dt}$$

$$= u\cdot(.05v) + v(.04u)$$

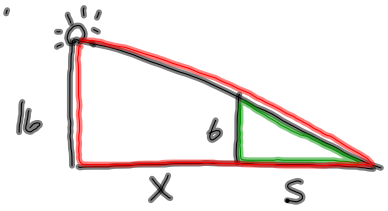
$$= .05uv + .04uv$$

$$= .09uv$$

$$\text{rel rate} = \frac{.09uv}{uv} = .09 = 9\%$$

Nov 1-9:43 AM

29.



Variables: x, s

$\frac{dx}{dt} = -5\ \frac{ft}{sec}$

$\frac{ds}{dt} =$ find

$$\frac{16}{x+s} = \frac{6}{s}$$

$$16s = 6x + 6s$$

$$10s = 6x$$

$$10\frac{ds}{dt} = 6\frac{dx}{dt}$$

$$10\frac{ds}{dt} = 6(-5)$$

$$\frac{ds}{dt} = -\frac{30}{10} = -3\ \frac{ft}{sec}$$

Nov 1-8:15 AM

4.6b Related Rates

Pancake batter pours on a griddle at the rate of 1000 cc per minute. The resulting circular pancake is 1 cm thick.
(a) Find an expression for the rate at which the radius grows. What does the expression tell you?
(b) How fast is the radius growing when it is 6 cm?

$\frac{dV}{dt} = 1000$

Variables: r, V

rates: $\frac{dr}{dt}$ = find

$\frac{dV}{dt} = 1000 \frac{cm^3}{min}$

$V = \pi r^2 \cdot 1$

$\frac{dV}{dt} = \pi \cdot 2r \frac{dr}{dt}$

$1000 = 2\pi r \frac{dr}{dt}$

$\frac{dr}{dt} = \frac{1000}{2\pi r}$

as r gets bigger $\frac{dr}{dt}$ gets smaller

the bigger the pancake the slower it expands

$\frac{dr}{dt} = \frac{1000}{2\pi \cdot 6} = 26.5258 \frac{cm}{min}$

Oct 27-1:51 PM

Water runs into a conical tank at the rate of 9 ft^3/min. The tank stands point down and has a height of 10 ft and a radius of 5 ft. How fast is the water level rising when the water is 6 ft deep?

variables: h, r, V

rates: ✓ $\frac{dh}{dt}$ = find

$\frac{dr}{dt} = ?$

✓ $\frac{dV}{dt} = 9$

$V = \frac{1}{3}\pi r^2 h$

$\frac{5}{10} = \frac{r}{h}$

$r = \frac{1}{2}h$

$V = \frac{\pi}{3}(\frac{h}{2})^2 h = \frac{\pi}{3}\frac{h^2}{4} \cdot h = \frac{\pi}{12}h^3$

$\frac{dV}{dt} = 3 \cdot \frac{\pi}{12} h^2 \frac{dh}{dt}$

$9 = \frac{\pi}{4} \cdot 6^2 \frac{dh}{dt}$

$9 = 9\pi \frac{dh}{dt}$

$\frac{dh}{dt} = \frac{9}{9\pi} = \frac{1}{\pi} \frac{ft}{min}$

Oct 27-1:53 PM

The volume of a sphere grows at a constant rate of ~~100 cc per min.~~ 9 mm³/sec
(a) How fast is the radius growing when it is ~~25 cm~~? 3 mm
(b)How fast is the surface area growing when the radius is ~~25 cm~~? 3 mm

variable: volume = V

radius = r

rates $\frac{dV}{dt} = 9$

$\frac{dr}{dt}$ = find

$V = \frac{4}{3}\pi r^3$

$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$

$9 = 4\pi \cdot 3^2 \frac{dr}{dt}$

$\frac{dr}{dt} = \frac{9}{9 \cdot 4 \cdot \pi} = \frac{1}{4\pi}$

Oct 27-2:03 PM